SILCOPAC SPDMR

RECTIFIER/REGENERATIVE CONVERTER FOR DC BUS

Answer Drives S.r.l. - Partially owned by Ansaldo Sistemi Industriali -S.p.A.

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SILCOPAC SPDMR

RECTIFIER/REGENERATIVE CONVERTER FOR DC BUS

Code:	IMSPD026I
Revision:	0.**4**
SW Version:	0.2 NRG
Date:	**Dec**-07

For further information and comment, please contact us at:

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PREFACE

This manual provides detailed information and the safety rules concerning the installation and startup, use and maintenance of the converters series SPDMR.

The manual has been written for Specialized operators involved in the installation, assembly, startup and maintenance of converters SPDMR, and it has three different safety typologies, indicated by the specific symbols to identify information requiring special attention:

CAUTION!

Indicates an incorrect action which may determine dangerous situations for the operators. Furthermore, it warns the personnel about possible dangers which may occur during the maintenance operations.

Dangerous Voltage It signals the presence of high voltages with the subsequent risk of death or electric shock for the operators.

It indicates the situations which may endanger the safety of people and/or damage the equipment.

WARNING

It indicates a procedure which should be performed or avoided to perform in a correct way operations of installation, repairing or replacement without damaging the inverter.

It indicates operations in whose field electrostatic discharges must be avoided.

Generic WARNING symbol.

REMARK

It is used to explain an instruction, an operation of repairing or other.

✓

Generic REMARK symbol.

CAUTION!

Make sure you fully read and understand this MANUAL before performing any intervention on the SPDMR.

SAFETY PRECAUTIONS

This section contains information about safety necessary and useful for the personnel operating with the SPDMR. The information is general and concerns the risks, for operators or for maintenance personnel, related to the operation and maintenance of the converter. The lack of observance of these rules may cause an hazard to the safety of people, with risk of death and of damaging the inverter, motor or operating machine.

Before operating with the unit, read the safety instructions.

CAUTION!

All the operations of electric maintenance and installation on the SPDMR must be performed by qualified technicians.

All the standard electric safety procedures must be respected:

- Never touch inside the converter; only after making sure there is not a high temperature and/or in voltage.
- Always wear protection shoes insulated, in rubber and protection glasses.
- Never work alone.
- Never connect to the system any grounded device of measurement or oscilloscope.
- Never remove safety screens.
- Always pay maximum attention when handling components or performing measurements inside the panel.

DANGER!

- The SPDMR and all the other devices connected MUST BE GROUNDED IN A SUITABLE WAY.
- The voltages on the terminals of output of the SPDMR are dangerous, be it when the drive is activated, be it when the same is not operating. Also consider that the motor may turn in any moment as soon as the power supply is connected.
- If the drive is installed in the panel, never operate it with the doors of the panel open.

DANGER! RISK OF FIRE, SERIOUS DAMAGE!

- Several converter has not internal fuses; foresee suitable fuses (see Chapter 8 for caliper and type). Do not use fuses different from those specified; wrong fuses may cause fire, serious damage to personnel equipment and/or parts connected nearby. Some units need auxiliary fuses for the separated lines related to the fans and auxiliary circuits.
- Do not apply power to the drive if you presume that inside of the container or of the components humidity has penetrated, dust or caustic/corrosive chemical agents.

DANGER! RISK OF FIRE, SERIOUS DAMAGE OR INJURIES!

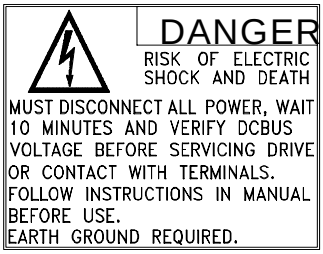
- SPDMR are devices of open type and must be installed strictly according to the instructions of this MANUAL and in total agreement with the standards and rules in force.
- Never store flammable material inside, over or near the inverter.

IT IS ABSOLUTELY FORBIDDEN TO

WARNING

- Operate the drive with voltage greater then the 10% of the rated value.
- Apply power to the terminals of output of the SPDMR.
- Connect SPDMR in parallel, directly on the terminals in output
- Connect capacitive loads to the terminals in output of the SPDMR

DANGER! RISK OF DEATH OR ELECTRIC SHOCK!


DANGER
RISK OF ELECTRIC SHOCK AND DEATH
MUST DISCONNECT ALL POWER, WAIT 10 MINUTES AND VERIFY DCBUS VOLTAGE BEFORE SERVICING DRIVE OR CONTACT WITH TERMINALS.
FOLLOW INSTRUCTIONS IN MANUAL BEFORE USE.
EARTH GROUND REQUIRED.

Before performing maintenance on the unit, strictly follow these safety points:

- Perform the procedure of block/exclusion of electric power supply and open the main disconnecting switch of the panel.
- Make sure that all the power supplies which reach the SPDMR (main and auxiliary power supply) are disconnected before performing maintenance on the drive.
- Await at least three (3) minutes after disconnecting power supply before performing maintenance on the unit. Refer to the safety plate existing on all the inverters.
- The SPDMR is supplied with many automatic functions of reset and restart which can restart automatically the unit. Do not activate these functions if there are dangerous situations.
- Do not change the distances of insulation, nor remove materials and insulation covers.
- Coordinate the voltage and the rated current of the load.
- If you must perform some insulation tests on the motor and on the cables, first disconnect the cables from the drive. Do not perform on the components of the SPDMR of the test by high potential.
- Pay attention not to damage any part of the SPDMR during the movement.
- Protect the drive from atmospheric agents and adverse environmental conditions (temperature, humidity, vibrations, collisions, etc). If you must store temporarily the inverter outside, take special precautions (see Chapter 2).

The SPDMR contains components sensitive to the electrostatic charges; such components may be damaged if handles in a non suitable way. During the operations of maintenance or replacement of the electronic cards, follow the points indicated here below:

Use a kit of maintenance for the electrostatic charges. You must take suitable precautions against the electrostatic discharge (ESD):

Wear static belts suitably grounded.

Handle the cards from the edges.

The cards should not enter in contact with highly insulating materials as plastic sheets, insulating surfaces, parts of synthetic tissues.

CAUTION!

The cards shall be located on conductive surfaces only

The cards must be packed in conductive sheets before the shipment.

Warranty and limitsof liability

WARRANTY: for the conditions of warranty please refer to the module “GENERAL CONDITIONS OF WARRANTY” enclosed to the Order Acceptation.

LIMITS OF LIABILITY: Answer Drives S.r.l. shall not be considered liable for missing technical information or errors in this manual, nor for accidental damages due to the use of the information contained in this manual.

A GENERAL FEATURES

The SILCOPAC D in the version for the regenerative braking (abbrev. SPDMR) are AC/DC converters for the power supply in direct current of the inverters, series GT3000
They are used in the applications in which there are drives performed with asynchronous motors, fed by one or more inverters connected to a common bus d.c., where the needs of the plant require special modalities of braking or a frequent use in regenerative operation.
In the classic configurations the braking power of the motors is dissipated on suitable resistance but, in the applications in which this energy is considered as important, it is convenient to use a converter DC/AC connected in antiparallel on the Bus DC to recover to the mains power supply the current generated by the group inverters-motors.

The control circuit is digital and it is single for the whole series SPDMR which ranges from size $110A_{cc}$ to $3800A_{cc}$.
The use of digital techniques offers important advantages:

- The drive can be easily configured via software according to the system characteristics;
- you can have a powerful diagnostics on the conditions of the drive;
- the operator can interact with the drive through a user's interface which allows him to exchange and display the data, commands, different information;
- It is possible to connect the drive in a centralized system of digital control, through a serial communication connection.

1A.1 Principle of operation

The part of power of the converter is made of two three-phase Graetz bridges by thyristors connected in antiparallel (figure 1.1 - 1), the first one to supply the bus d.c. (operation as feeder), the second to recover in the mains the energy generated by the inverters (regenerative operation).

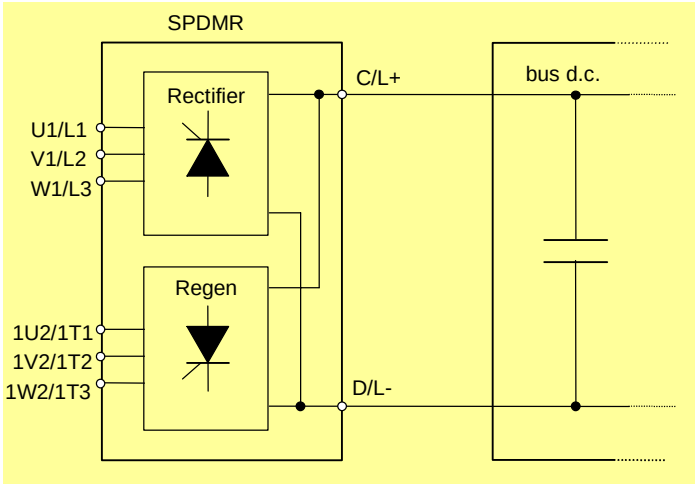


Figure A1.1 - 1

The control circuit commands the two bridges in order to keep constant the voltage on the bus d.c., either during the motorizing operation of the inverters, or during the regenerative operation.
The SPDMR converters have been designed to operate in regenerative mode in a continuative way, up to the rating current and their use allows an important saving of energy in those cases in which the inverters frequently toggle from motorizing to regenerative operation.
Besides the normal operations of power supply of the bus d.c. and of regenerative braking, the converter SPDMR can be used also to perform the precharge of the bus d.c.
To ensure the correct operation in regenerative mode with constant output voltage, the voltage of power supply of the regenerative bridge must be risen by 20 ÷ 25% with an autotransformer, compared to the power supply voltage of the rectifying bridge (figure 1.1 - 2).

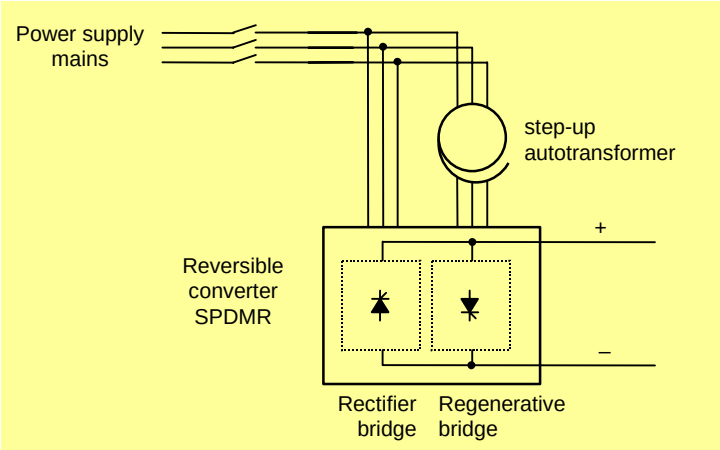


Figure A1.1 - 2

The simplified diagram of the control is illustrated in figure 1.1 – 3.

The control operates so that when the voltage on the bus d.c., by effect of the operation in regenerative mode of the inverters, tends to rise besides a reference value V_{ref} , the regenerative bridge starts to conduce current from the bus d.c. to the mains, keeping the voltage at value V_{ref} .

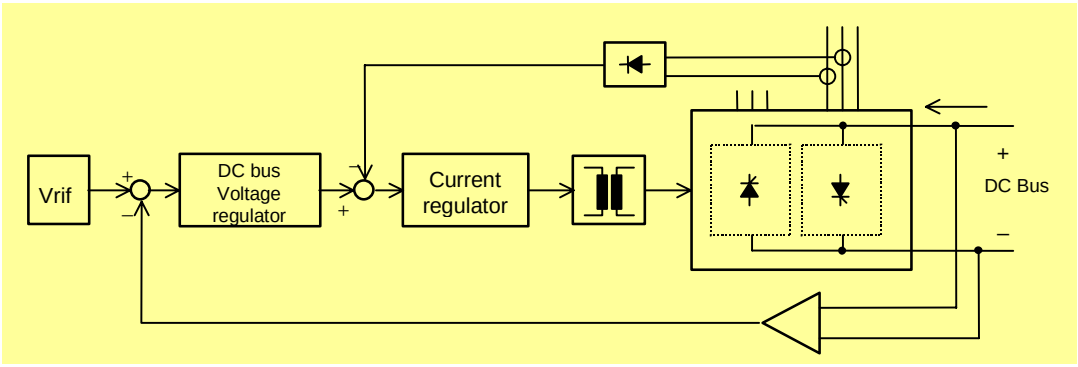


Figure A1.1 - 3

1A.2 Reception controls

Upon the reception, the packaging must be integral and without signs of shocks.

When opening the packaging, check that the content corresponds to the equipment ordered, verifying the code which is located on the plate applied on the side of the converter.

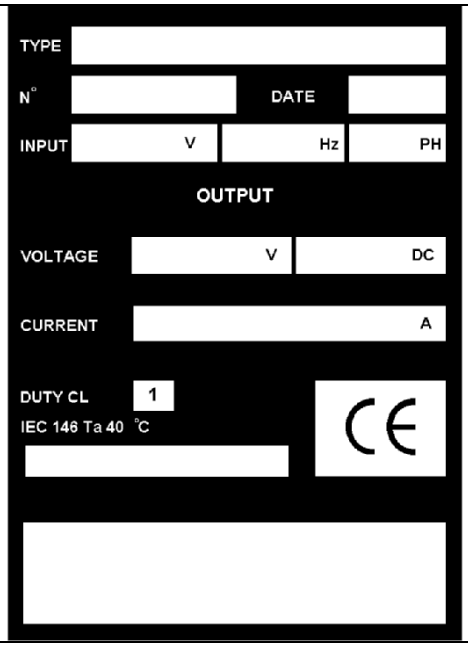
Serial Number Power supplì Voltage Rated output Voltage (V) Rated output Current (A) Code Bar Code		SPDM Identification Product test date Line Frequency and Phases

Figure A1.2 - 1: Plate applied to the converter

Verify that there are eventual options required. The options (normally supplied as separated) are accompanied by the accessories and the instructions for installations and startup with the drive.
Each equipment is accompanied by the following documents:

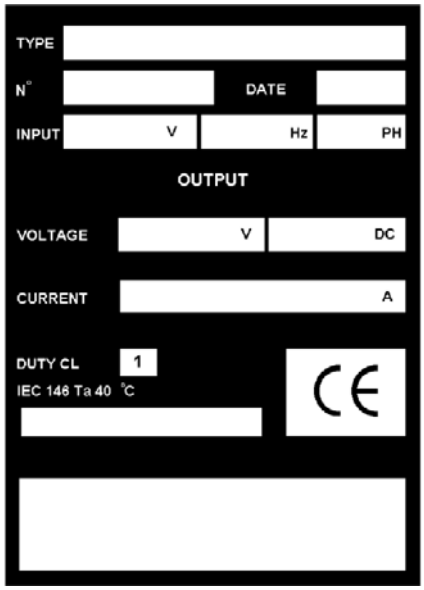
- Product card (Code mod.25)
- Test report (Code 8CP9998).
- Manual
- Parameterization sheets (Test configuration)

Verify that the equipment does not show any sign of damage, checking the status of the framing and the closing front panel; check that the internal connections are integrated and correct; also check the integrity of the cards.

1A.3 Storage

If the converter is not installed immediately, it must be stored in a clean and dry environment, keeping it in its original packaging. Where the mentioned conditions cannot be observed, protect the equipment with waterproof coverings.
The storage temperature must range between –30°C and +85°C.

SPDMR	SCHEDA PRODOTTO / PRODUCT SHEET MOD. / TYPE 25-9				
A.O. / ORDER CONF.					
CONSEGNA RICHIESTA / DELIVERY TIME:.					
CLIENTE / CUSTOMER.					Euro
ORDINE CLIENTE / P.O.:.					
1	QUANTITA` / QUANTITY				
2	CONVERTITORE / CONVERTER				
3	RETE DI ALIMENTAZIONE./ POWER SUPPLY.				
4	MANUALE IST.	❒ Italiano/ Italian	❒ Inglese/English		
5	USER MANUAL	❒ Francese/ French	❒ Tedesco/ German		
	OPZIONI / OPTIONS				
6	SPDI1	Tastiera / Keypad			
7	SPDI2	Tastiera con connettore CENTRONICS			
8	SPDKS	Keypad with CENTRONICS connector Kit di remotaggio SPDI1/SPDI1 remote kit			
9	SPRI1	Kit remotaggio connettore SPDI1/2 /SPDI1/2 connector remote. kit		28730753	
10	SPDI/O	Espansione I/O digitali / Logic I/O Expansion		25908304	
11	SPDS1	Seriale RS485 / Serial link RS485		25908306	
12	FLAT-CABLE	SPDI1/2 - SPRI1		20642202	
13	FILTRO RC /RC FILTER				
14	REATTORE TRIFASE / THRE PHASE LINE REACTOR			223862	
15	ATRS 50	AUTOTRASFORMATORE SINCRONISMO	❒ 415-440-480-500/380	204699	
16	ATRS 22	SYNCHRONISM AUTOTRANSFORMER	❒ 220-240/380	206698	
17	FUSIBILI U.R.	❒ lato CA / AC Side	Q.ta' / Q.ty	20653	
	U.F. FUSE	❒ lato CA / AC Side	Q.ta' / Q.ty	21242	
18		❒ lato CC / DC Side	Q.ta' / Q.ty	20653	
		❒ lato CC / DC Side	Q.ta' / Q.ty	21242	
19	BASE PORTAFUSIBILE.	❒ 80 mm	Q.ta' / Q.ty	206535	
	FUSE HOLDER	❒ 110 mm	Q.ta' / Q.ty	212430	
20	AL24 ALIMENTATORE 24VC.C. PER I/O DIGITALI / LOGICS I/O 24 VD.C. POWER SUPPLY			420166	
				TOTALE / .TOTAL AMOUNT	
COMPILATORE / EDITOR:		APPROVAZIONE / APPROVED BY:		DATA / DATE:	



2A Identification code

The SPDMR is identified by the following mark:

SPDMR	X X X	X	X	N	X
					SUFFIX
					50 = Frame V (version 2 fan) 51= Frame IV without collector bars (CT loose) 40 = Frames IV-V with fuses trip indicator
				CONNECTION	
				R = reverse bridge generating	
				F = forward bridge motoring	
				blank = base version (forward and reverse bridges)	
			FAN POWER SUPPLY VOLTAGE		
			S = 230V / 60Hz		
			D = Standard version		
			G = 440V 60Hz 1,65A		
		POWER SUPPLY VOLTAGE			
		4quadrant		2 quadrant (connections R-F)	
		D = 400/500 V G = 500/625 V K = 690/860 V W= 750/937 V		G = 500 V K = 690 V W= 750 V M= 850 V N= 950 V	

CURRENT (A)	Power supply voltage	frame
110	G	I
350	G	II
600	G	III
750	K	IIILL
1K0	G	IIILL
1K5	K-W – (NDR)	IV
1K7	K	IV
2K0	D - G	IV
2K5	G – K - W	V
3K6	G – K - W – (NDR)	V
3K8	G	V

REMARK

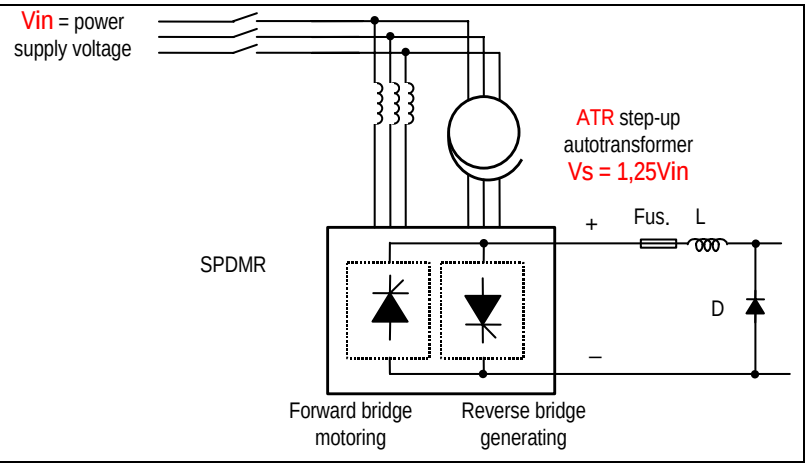
The power supply voltage (specified by letters D, G or K) refers to the rectifier bridge. The regenerating bridge is sized to be supplied with a voltage which is at maximum 1.25 times the voltage of the feeding bridge.
Example: on converter SPDMR600G it may be applied at the rectifier bridge a **maximum voltage** of 500V (+10%) and to the regenerating bridge a **maximum voltage** of 625V (+10%).

SPDMR Circuit Typology

1) Standard connection"

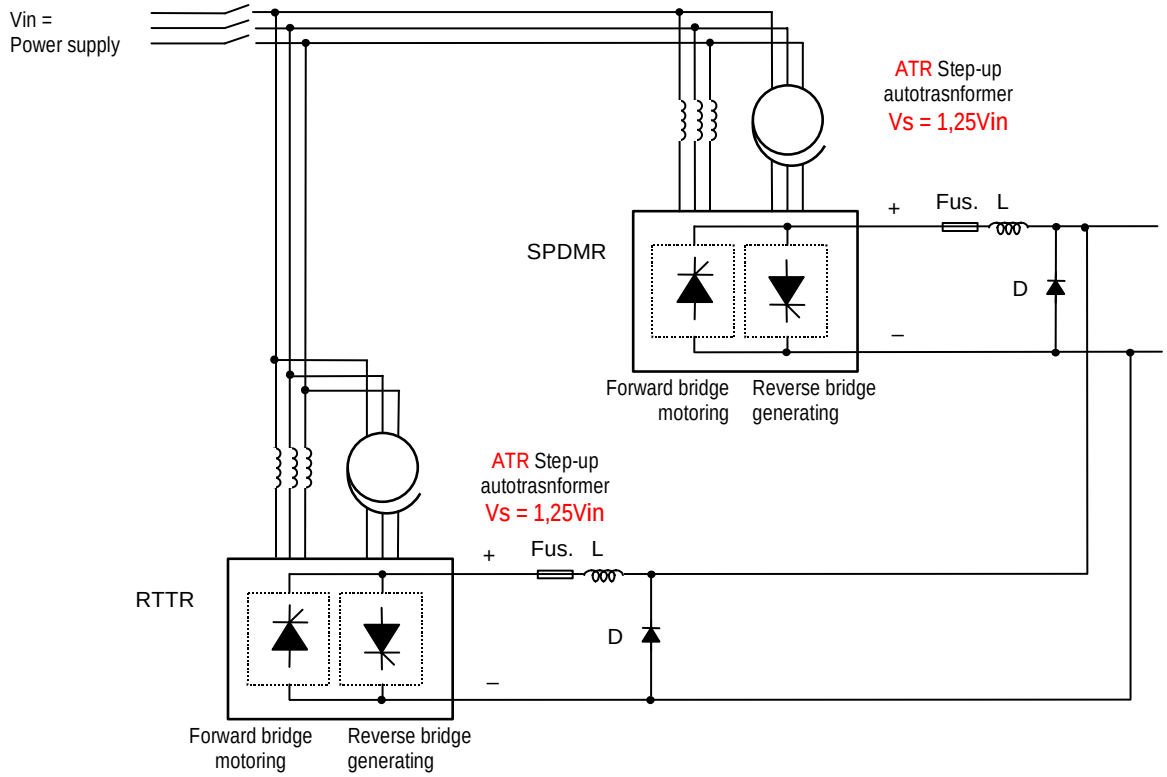
It is the standard application described in this manual: it is used a four quadrant converter.

The letter that identifies the power supply voltage refers to the forward bridge.
(for example W means that it may be applied to the forward bridge a maximum voltage of 750V and to the reverse bridge a maximum voltage of 1,25 * 750 = 937V).

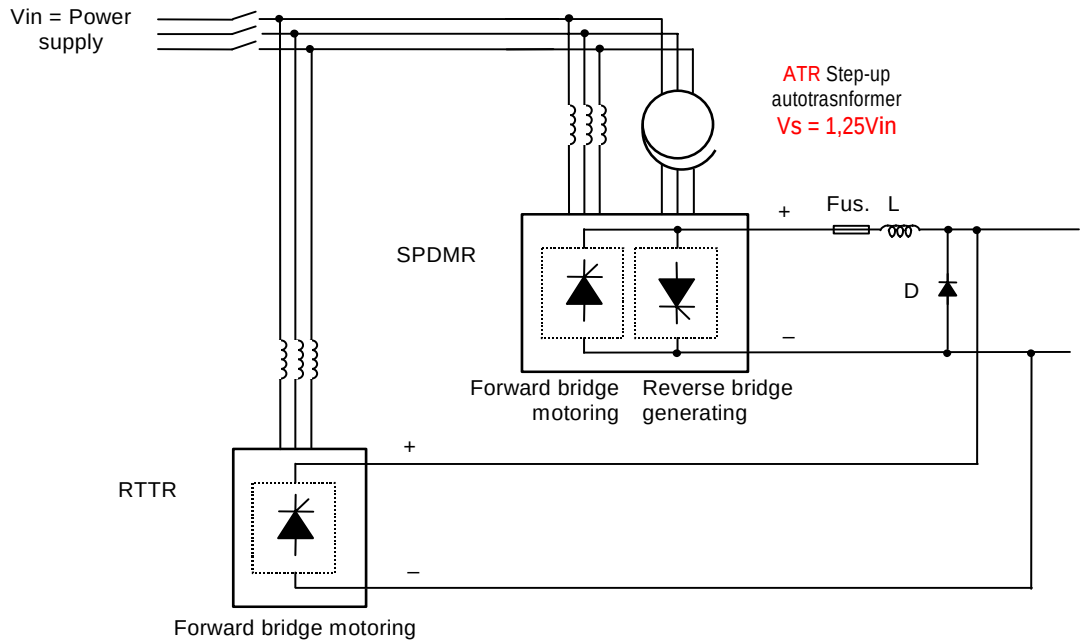


This configuration can be made also with two or four quadrant parallel bridges (RTTR).

The parallel between the SPDMR and rhe RTTR must be done taking the same criteria used for SPDM and RTT bridges.
If the parallel is made with four quadrant RTTR, it is necessary to double the circuit on DC side composed by the choke, the free wheeling diode and the fuse.



If the parallel is made with two quadrant RTTR, it is not necessary the choke, the free wheeling diode and the fuse.

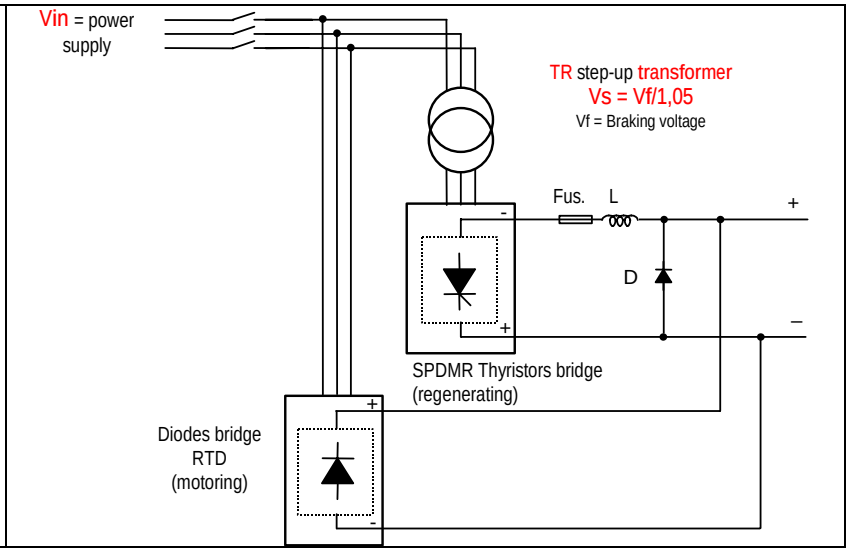


2 Regenerating connection only”

This application use a diode bridge for motoring (RTD) and a thyristor bridge for regenerating SPDMR.

Define the operating voltage class according the secondary voltage (Vs) of the transformer
(ex. G Vs= 500 V)

The output +SPDMR must be connected to terminal – of the RTD and
the output –SPDMR to the terminal +RTD



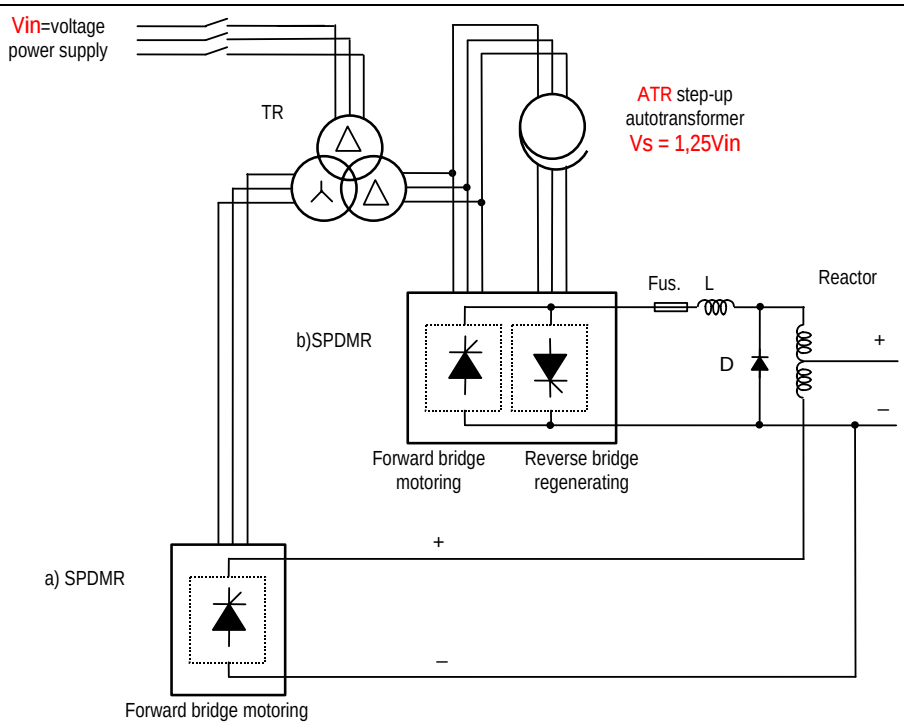
WARNING!: in this application the SPDM power supply must be insulated from RTD power supply (a transformer must be used).

3 Twelve pulse connection

This application use a two converters.

The converter SPDMR a) is a sinle bridge converter (motoring) in twelve pulse configuration.

Define the operating voltage class according the secondary voltage of the transformer TR.
(ex. G Vs= 500 V)



Application 2-3: SPDMR are identical to SPDM (2 quadrant) [The only difference is the control bord (“COREA” instead of CONDB)]. Refers to SPDM manual for power connections.

With the same BUS DC voltage, the SPDMR two quadrant (application 2) must be suitable for an operating voltage greater than the application 3 (at list 1,25)

The SPDMR concerning the applications 2 and 3a are identical, the only difference is the internal voltage transducer connection. The applications 3b SPDMR is identical to the application 1SPDMR.

It is possible to parallel the converter SPDMR: The slave converter (without control board) is named RTTR

3A TECHNICAL DATA

TYPE	SIZE	CURRENT	LOSSES	MAINS VOLTAGE (1)				BLOWER
		A	W	D	G	K	W	
SPDMR110G	I	110	350		x			
SPDMR350G	II	350	1100		x			with two fans single phase 220÷230 V 50 / 60 Hz0.15 A
SPDMR600G	II	600	1850		x			with a fan single phase 220÷230 V 50 / 60 Hz0.35 A
SPDMR750K	IIIL	750	2700			x		
SPDMR1K0X	IIIL	1000	3700	x	x			with a fan single phase 220÷230 V 50 / 60 Hz0.88 A
SPDMR1K5X	IV	1500	5400			x	x	with a fan three phase 380÷400 V 50 Hz / 440 V 60 Hz
SPDMR1K7X	IV	1700	6100			x		2.2 A
SPDMR2K0X	IV	2000	7150	x	x			
SPDMR2K5X	V	2500	8900		x	x	x	with a fan three phase 380÷400 V 50 Hz / 440 V 60 Hz
SPDMR3K6X	V	3600	12700		x	x	x	1.7/2.A
SPDMR3K8G	V	3800	14100		x			

Table 3A.1

REMARK The mains voltage indicated is the power supply voltage of the forward bridge. The power supply voltage of the recovery bridge must be 1.2÷1.25 times that of the forward bridge.

(1)	X	Power supply voltage		Output voltage
		Feeding bridge V_{ON} [V]	Recovery bridge V_{REG} [V]	Vout [V]
	D	3 x 380÷415 ±10%	3 x 460÷520	510÷560
	G	3 x 440÷500 ±10%	3 x 530÷625	590÷675
	K	3 x 660÷690 ±10%	3 x 790÷860	890÷930
	W	3 x 750 ±10%	940	1010
	N		3 x 950 ±10%	

Mains voltage : power "D- G- K - W" ±10%
: control 380 V ±15% 30 VA
400 V +10% - 20% 30 VA

Frequency 45 - 65 Hz with automatic adaptation to the value of frequency and to the cyclic sense.

Dead zone on the current inversion: min. 3,3 ms

Ambient Temperature : 0 - 40°C
Reduce the rating current by 1.2% for every °C
between 40°C and 65°C max .

Altitude : 0 - 1000 m a.s.l.
Reduce the rating current by 1% for every 100 m between 1000 and 3000 m max.

Storage Temperature.: -30 +70°C

Relative Humidity : 95% max (without condensate)

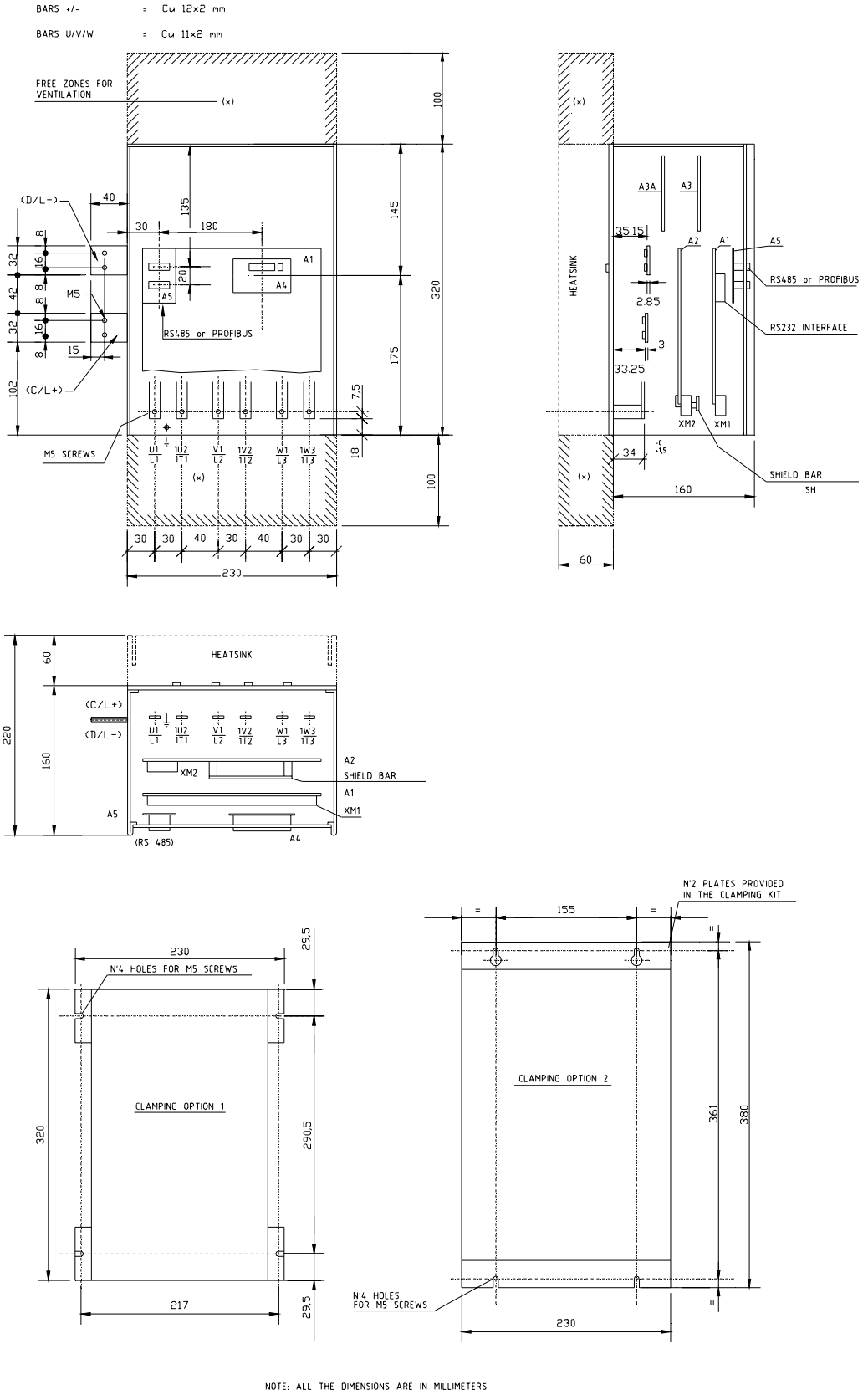
The product line Silcopac D complies with the Standard IEC 146.1.1/1991 is coordinated compared to the conditions which can be applied to the Standard CEI EN 60204.1/1993 (IEC 204.1/1992) "Electric equipment of the Machines ".
The compliance to the standard, which is harmonized to the Community Directives 2006/95/EC "Directive on Low Voltage " and CEE 89/392 "Directive on Machines ", allows the use of the product in a machine equipment undergoing CE markup.
The product line Silcopac D is also complying, according to the tests performed, with the EN61800-3.
The EN61800 is the EMC European Standard for adjustable speed electrical power drive system

CAUTION! For safety reason, all fuses must be always provided with the auxiliary switch for trip indication.
The SPDMR frame V have the auxiliary switch as standard.

4A MOUNTING

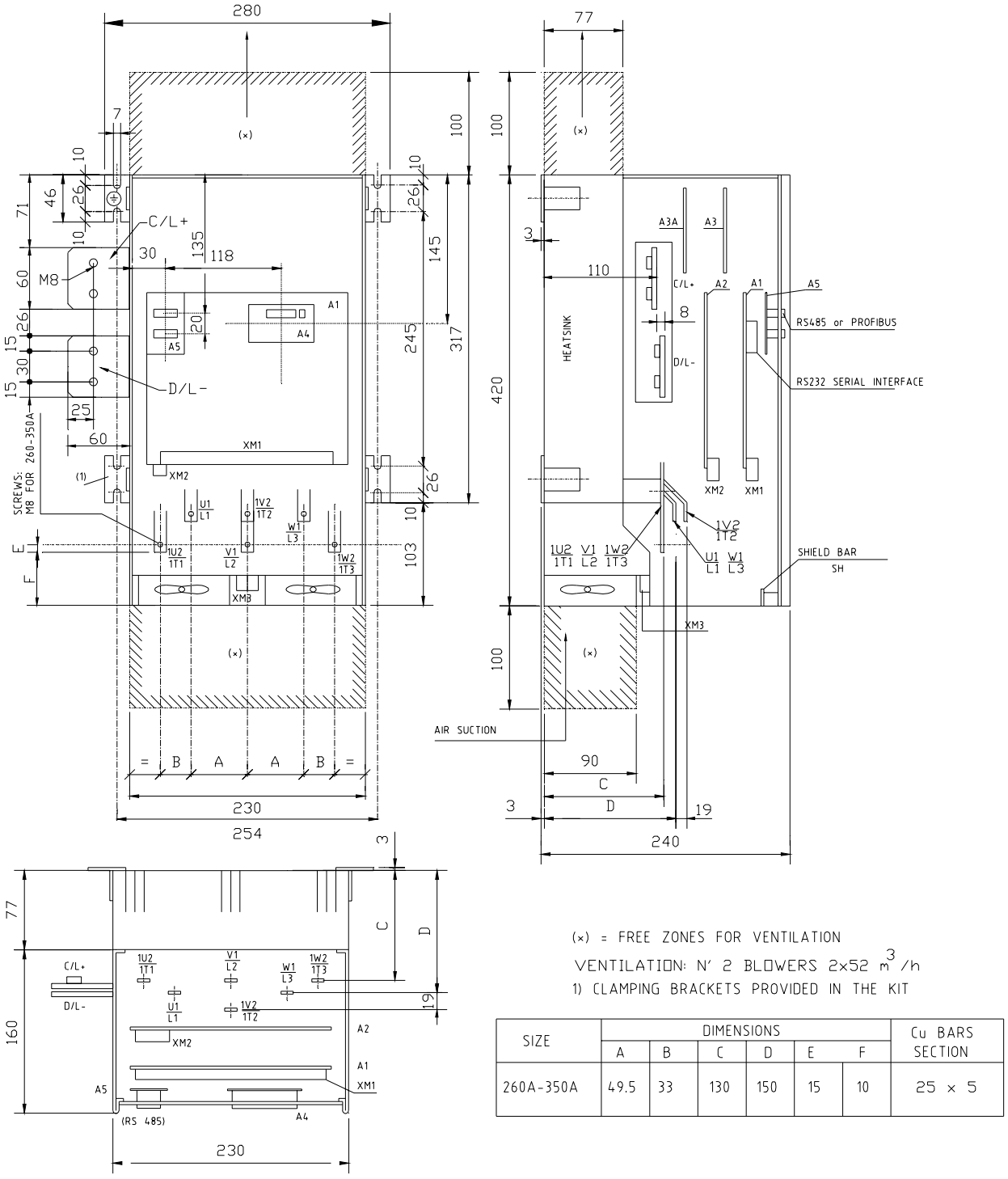
Outline dimension, mounting, safety clearance

SIZE I



NOTE: ALL THE DIMENSIONS ARE IN MILLIMETERS

SIZE II



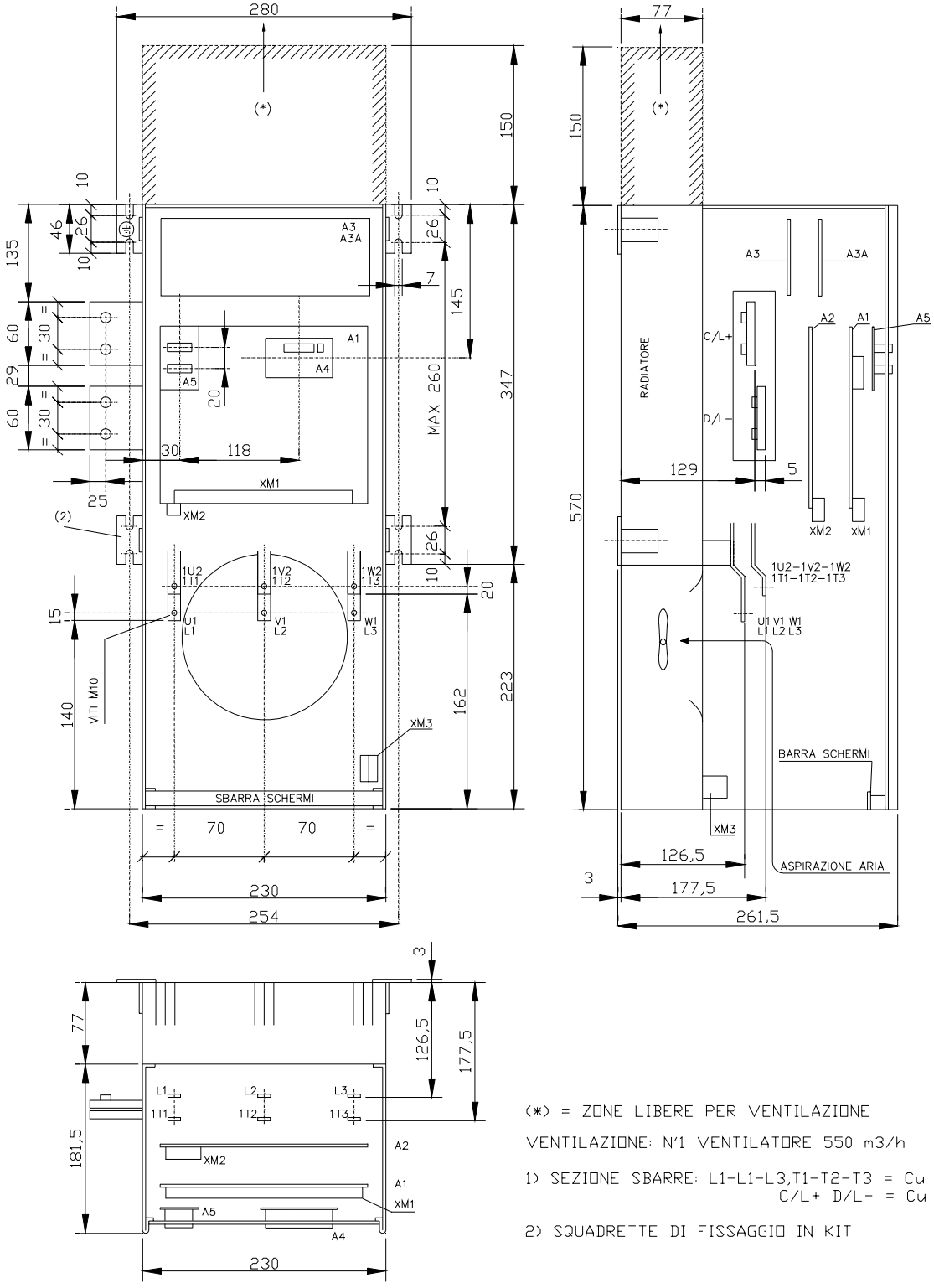
(×) = FREE ZONES FOR VENTILATION

VENTILATION: N° 2 BLOWERS 2x52 m^3/h

1) CLAMPING BRACKETS PROVIDED IN THE KIT

SIZE	DIMENSIONS						Cu BARS SECTION
	A	B	C	D	E	F	
260A-350A	49.5	33	130	150	15	10	25 x 5

SIZE III



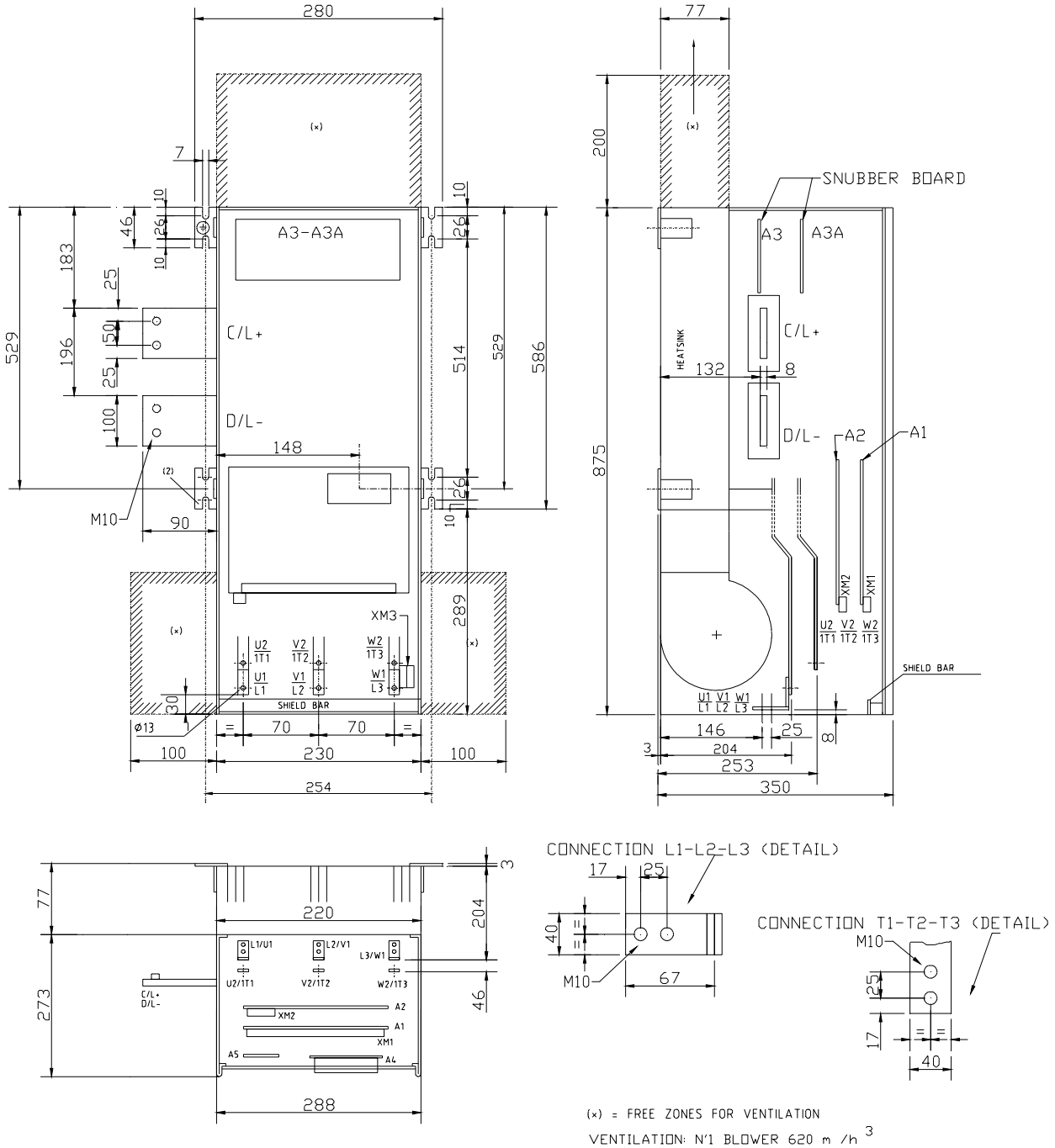
(*) = ZONE LIBERE PER VENTILAZIONE

VENTILAZIONE: N'1 VENTILATORE 550 m3/h

1) SEZIONE SBARRE: L1-L1-L3,T1-T2-T3 = Cu 30x6
C/L+ D/L- = Cu 60x3

2) SQUADRETTE DI FISSAGGIO IN KIT

SIZE IIIL



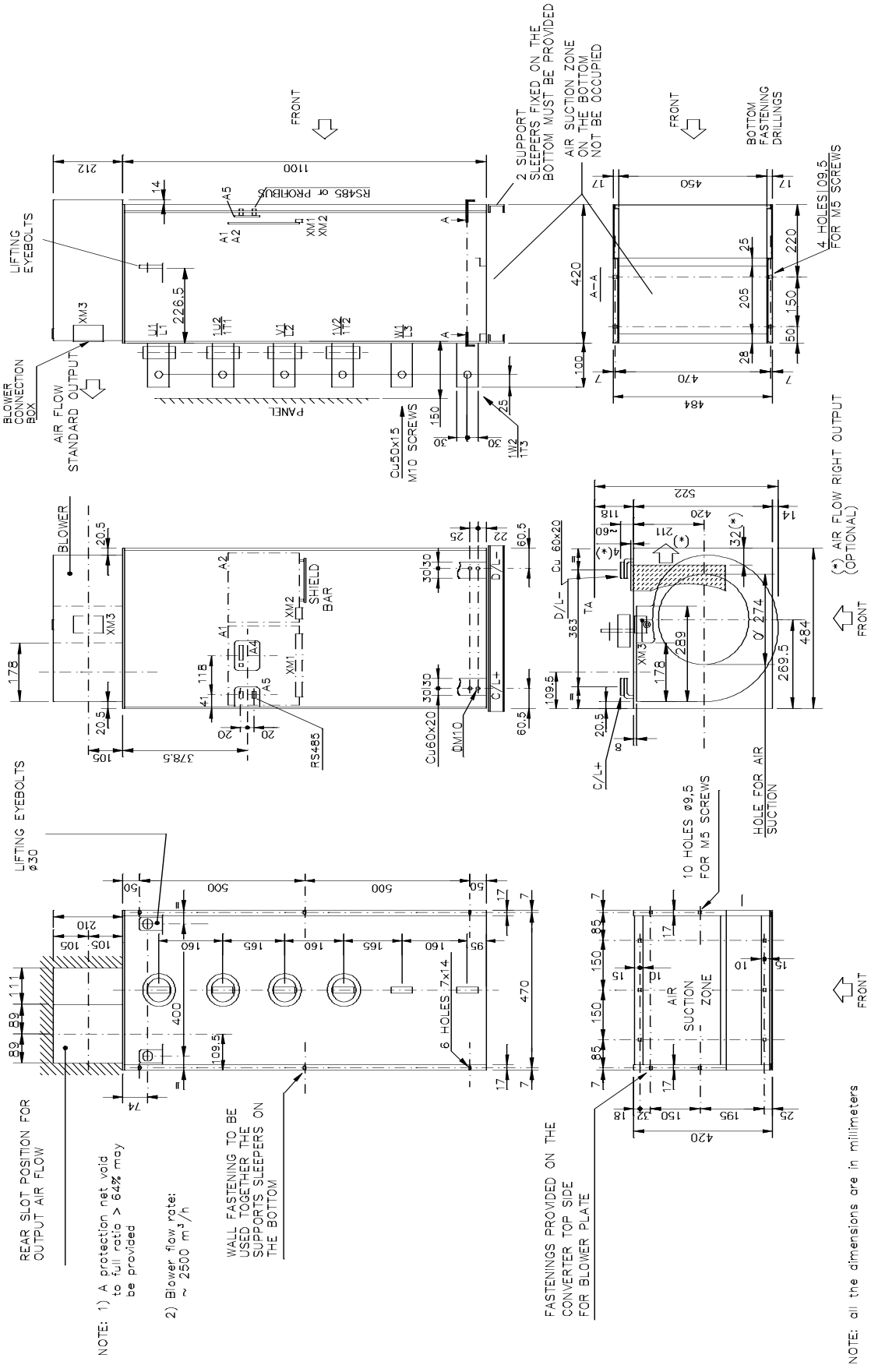
(×) = FREE ZONES FOR VENTILATION

VENTILATION: N°1 BLOWER 620 m^3/h

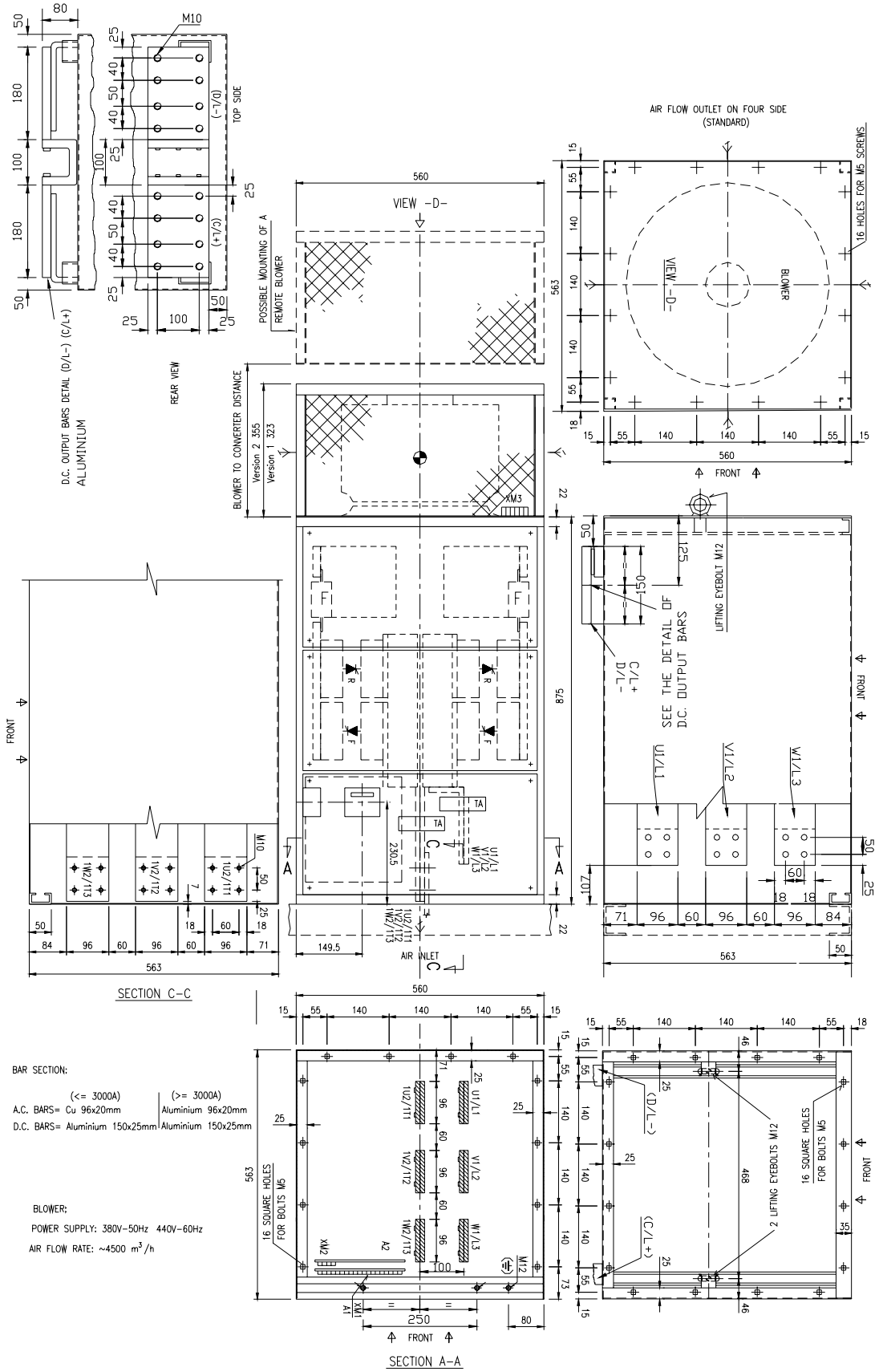
1) Cu BARS SECTION: 60 x 10

2) CLAMPING BRACKETS PROVIDED IN THE KIT

SIZE IV


FRONT
2 SUPPORT SLEEPERS FIXED ON THE BOTTOM MUST BE PROVIDED
AIR SUCTION ZONE ON THE BOTTOM NOT BE OCCUPIED
BOTTOM FASTENING DRILLINGS
4 HOLES Ø9,5 FOR M5 SCREWS
LIFTING EYEBOLTS
BLOWER CONNECTION BOX
AIR FLOW STANDARD OUTPUT
PANEL
Cu50x15 M10 SCREWS
BLOWER
SHIELD BAR
RS485
Cu 60x20
ØM10
(*) AIR FLOW RIGHT OUTPUT (OPTIONAL)
HOLE FOR AIR SUCTION
LIFTING EYEBOLTS Ø30
10 HOLES Ø9,5 FOR M5 SCREWS
6 HOLES 7x14
AIR SUCTION ZONE
REAR SLOT POSITION FOR OUTPUT AIR FLOW
WALL FASTENING TO BE USED TOGETHER THE SUPPORTS SLEEPERS ON THE BOTTOM
FASTENINGS PROVIDED ON THE CONVERTER TOP SIDE FOR BLOWER PLATE
NOTE: 1) A protection net void to full ratio > 64% may be provided
2) Blower flow rate: ~ 2500 m³/h
NOTE: all the dimensions are in millimeters

SIZE V


M10
TOP SIDE
(-1/0)
(+1/0)
D.C. OUTPUT BARS DETAIL (D/L-) (C/L+)
ALUMINIUM
REAR VIEW
POSSIBLE MOUNTING OF A REMOTE BLOWER
VIEW -D-
BLOWER TO CONVERTER DISTANCE
Version 2 355
Version 1 323
AIR FLOW OUTLET ON FOUR SIDE
(STANDARD)
16 HOLES FOR M5 SCREWS
BLOWER
FRONT
SEE THE DETAIL OF
D.C. OUTPUT BARS
LIFTING EYEBOLT M12
U1/L1
V1/L2
W1/L3
AIR INLET
SECTION C-C
SECTION A-A
BAR SECTION:
(<= 3000A)
(>= 3000A)
A.C. BARS= Cu 96x20mm
Aluminium 96x20mm
D.C. BARS= Aluminium 150x25mm
Aluminium 150x25mm
BLOWER:
POWER SUPPLY: 380V-50Hz 440V-60Hz
AIR FLOW RATE: ~4500 m3/h
16 SQUARE HOLES FOR BOLTS M5
16 SQUARE HOLES FOR BOLTS M5
LIFTING EYEBOLTS M12

Frame V (SPDM2K2-2K5-3K1-3K6-4K0)

FAN

The fan is delivered loose (not installed on the SPDM).

Up to 09.16.2005 two versions was available.

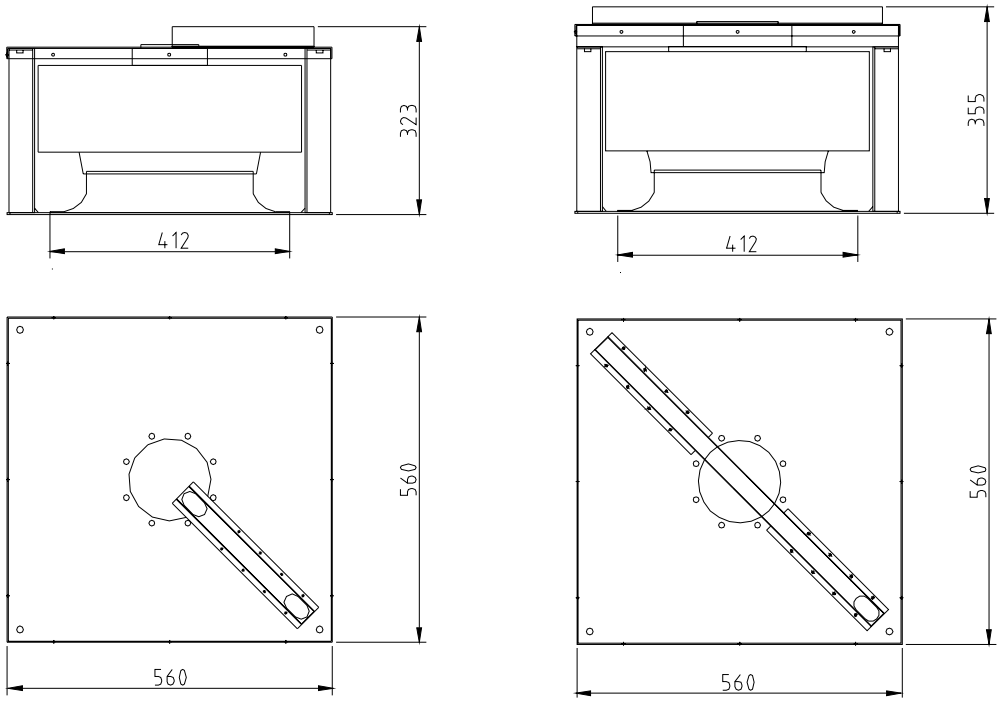
Version 1: standard .

Version 2: optional, (indicated with suffix 50 on the identification code).

After this date the version two is available only. The identification code for every SPDM will have the suffix 50.

NOTE: the remarks above mentioned are valid also for the RTTR frame V.

VERSION 1	VERSION 2



4A.2 Weights and dimensions

Silcopac D type	Frame	width mm	height mm	depth mm	weight kg
SPDMR110G	I	230	320	220	11
SPDMR350G	II	230	420	240	17
SPDMR600G	III	230	570	262	26
SPDMR750K	IIIL	230	875	350	57
SPDMR1K0x	IIIL	230	875	350	57
SPDMR1K5x	IIIL	230	875	350	57
SPDMR1K7K	IV	484	1100(+212)	420	125
SPDMR2K0x	IV	484	1100(+212)	420	125
SPDMR2K5x50	IV	484	1100(+212)	420	125
SPDMR3K6x50	V	560	875(+355)	563	200
SPDMR3K8x50	V	560	875(+355)	563	320
SPDMR3K8G	V	560	875(+355)	563	320